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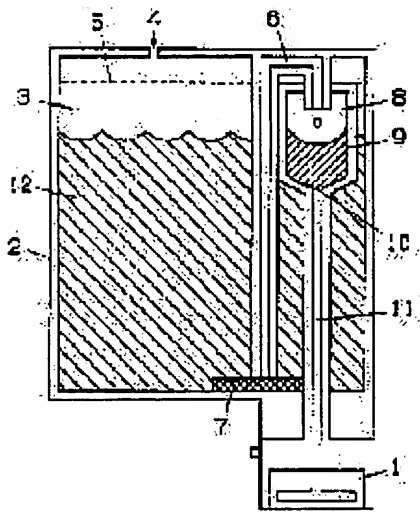
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**(54) INK JET CARTRIDGE**



**(57)Abstract:**

**PURPOSE:** To obtain a highly reliable ink jet cartridge always properly keeping an ink pressure to be supplied to a recording head even if the cartridge is differently handled or a change in external environment, such as fluctuation of air temperature or air pressure, occurs.

**CONSTITUTION:** A first chamber 3 and a second chamber 8 are connected to each other through a duct line 6. An end of the duct line 6 on the side of the second chamber 8 has an ink repellency. The pressure of the second chamber 8 is adjusted by a proper surface tension of ink. On the other end of the duct line 6 on the side of the first chamber 3, a first porous member is provided to prevent air in the first chamber 3 from intruding into the duct line 6 even if the cartridge is disposed upside down. The capacity of air in the second chamber 8 is determined to be not more than three times larger than the capacity of the duct line 6. A pressure change in the second chamber 8 caused by a change in air temperature or air pressure is absorbed by the duct line 6. In this

manner, an ink pressure to a recording head 1 is kept constant.

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CLAIMS

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[Claim(s)]

[Claim 1] In a recording head and the ink jet cartridge used for the ink jet recording apparatus which has an ink tank The 1st \*\* which said ink tank mainly stores ink and has opening with atmospheric air, The ink jet cartridge characterized by the bottom so that it may have a porosity member in opening by the side of the 1st [ of the duct which connects the 2nd sealed \*\* which has a porosity member, and said the 1st \*\* and said 2nd \*\*, and this duct ] \*\* and ink may trickle from the tip by the side of the 2nd [ of said duct ] \*\*.

[Claim 2] In a recording head and the ink jet cartridge used for the ink jet recording apparatus which has an ink tank The 1st \*\* which said ink tank mainly stores ink and has opening with atmospheric air, It has the duct constituted so that the 2nd sealed \*\* which has a porosity member, and said the 1st \*\* and said 2nd \*\* might be connected and the opening tip by the side of the 2nd \*\* might have water repellence at least. The ink jet cartridge characterized by the bottom so that ink may trickle from the tip by the side of the 2nd [ of said duct ] \*\*.

[Claim 3] In a recording head and the ink jet cartridge used for the ink jet recording apparatus which has an ink tank The 1st \*\* which said ink tank mainly stores ink and has opening with atmospheric air, The ink jet cartridge characterized by the bottom so that it may have the duct which connects the 2nd \*\* by which the porosity member which has a crevice was allotted and sealed, and said the 1st \*\* and said 2nd \*\* and ink may trickle from the tip by the side of the 2nd [ of this duct ] \*\*.

[Claim 4] In a recording head and the ink jet cartridge used for the ink jet recording apparatus

which has an ink tank The 1st \*\* which said ink tank mainly stores ink and has opening with atmospheric air, The ink jet cartridge characterized by having the duct which connects the 2nd sealed \*\* which has a porosity member, and said the 1st \*\* and said 2nd \*\*, and the volume of said 2nd \*\* being constituted by 3 or less times of the volume of said duct.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the ink jet cartridge used for an ink jet printer.

[0002]

[Description of the Prior Art] As for a printer, in an ink jet cartridge, the liquid ink side of an ink tank may become higher than a recording head nozzle side constitutionally. In such a case, the water head differential pressure by difference of height joins the nozzle side of a recording head, and ink flows out from a nozzle. In order to prevent this, a means to generate negative pressure is needed in an ink tank.

[0003] Into this ink tank, as a means to generate negative pressure, porous members, such as sponge, are arranged in an ink tank, and the method of using that capillary tube force is common, and is used widely. However, it had the fault of being unable to exhaust the ink with which could not fill up sponge with ink completely and it filled up, and the miniaturization of a cartridge was difficult. Moreover, although the method of preparing a pressure adjustment valve between an ink tank and a recording head was also proposed, while becoming expensive, it was easy to produce failure of a pressure adjustment valve, and was not suitable for actual use.

[0004] Moreover, there is a technique which connects the 1st \*\* which stores ink which is indicated by Japanese Patent Application No. No. 285745 [ three to ], the 2nd sealed \*\*, and the 1st \*\* and 2nd \*\* with a capillary tube. With this technique, ink is supplied to the 2nd \*\* by the differential pressure of the atmospheric pressure concerning the 1st indoor ink, and the 2nd indoor negative pressure by consumption of the ink in a recording head through a capillary tube. At this time, ink \*\* in the 2nd \*\* and recording head is fixed with the surface tension of ink in opening by the side of the 2nd [ of a capillary tube ] \*\*.

[0005] According to this technique, ink can be supplied to a recording head by the proper pressure. However, when a cartridge is held to reverse depending on the processing method of a cartridge, for example, the air of the 1st \*\* may enter into the 2nd \*\* through a capillary tube, the pressure in the 2nd \*\* may rise, and good negative pressure cannot be held to a recording head, but ink may be spilt out from the nozzle of a recording head. Moreover, there was a problem of it becoming impossible for that the air of the 2nd \*\* will enter in a capillary tube by fluctuation of an atmospheric pressure or change of temperature if the volume of the air of the 2nd \*\* changes, the inside of a capillary tube will be filled with air, for example, the 2nd indoor air escapes to the 1st \*\* etc. to maintain the balance of the pressure by the capillary tube force.

[0006]

[Problem(s) to be Solved by the Invention] This invention aims at offering a reliable ink jet cartridge by having been made in view of the situation mentioned above, losing the leakage and \*\*\*\*\* of ink by the handling of a cartridge, change of atmospheric temperature, and change of the external environment of fluctuation of an atmospheric pressure, and making always proper the ink pressure supplied to a recording head.

[0007]

[Means for Solving the Problem] In the ink jet cartridge which uses this invention for the ink jet recording apparatus which has a recording head and an ink tank said ink tank The 1st \*\* which mainly stores ink and has opening with atmospheric air, and the 2nd sealed \*\* which has a porosity member, As it has the duct which connects said the 1st \*\* and 2nd \*\* and ink trickles from the tip by the side of the 2nd [ of said duct ] \*\*, in invention according to claim 1, it is characterized by having a porosity member in opening by the side of the 1st [ of said duct ] \*\*. Moreover, in invention according to claim 2, it is characterized by the thing of said duct constituted so that the opening tip by the side of the 2nd \*\* may have water repellence at least. Furthermore, in invention according to claim 3, it is characterized by establishing a crevice in the porosity member allotted to said 2nd \*\*. In invention according to claim 4, it is characterized by the volume of said 2nd \*\* being constituted by 3 or less times of the volume of said duct.

[0008]

[Function] Since ink is held by the porosity member even when a cartridge is made reverse in invention according to claim 1 by preparing a porosity member in opening by the side of the 1st [ of a duct ] \*\* according to this invention, it can prevent air invading in a duct. Moreover, in invention according to claim 2, it can prevent that the front face of an ink droplet becomes large unusually at opening of a duct, and the balance of ink \*\* collapses by [ of a duct ] giving water repellence at the tip of opening by the side of the 2nd \*\* at least. Furthermore, in invention according to claim 3, even when ink trickles aslant from opening of a duct by some inclinations by establishing a crevice in the porosity member allotted to the 2nd \*\*, while being able to make a porosity member absorb ink certainly, the ink absorbed by the porosity member and the dropped ink can be held, without winning air. In invention according to claim 4, when the volume of the 2nd \*\* is constituted by 3 or less times of the volume of a duct, even if the 2nd indoor air expands and it invades in a duct by change of temperature or an atmospheric pressure, the overall length of a duct is not filled by air. By these configurations, change of ink \*\* by change of the environment of change of handling and temperature of a cartridge, or an atmospheric pressure can be suppressed, and always good ink \*\* can be secured.

[0009]

[Example] Drawing 1 is the outline block diagram showing one example of the ink jet cartridge of this invention. the inside of drawing, and 1 -- the recording head section and 2 -- an ink tank and 3 -- the 1st \*\* and 4 -- an atmospheric-air free passage hole and 5 -- a mesh member and 6 -- for the 2nd \*\* and 9, as for a filter and 11, the 2nd porosity member and 10 are [ a duct and 7 / the 1st porosity member and 8 / passage and 12 ] ink. A recording head 1 consists of a heat sink with which the head chip was attached, a printed-circuit board which supplies an electrical signal to a head chip, a manifold which supplies ink to a head chip. It is not illustrating about these configurations. Many nozzles are formed in the head chip by high density. For example, 128 nozzles can be arranged by the consistency of 300spi(s). Each nozzle is made to generate air bubbles by energization, and the heating element for injecting an ink droplet is prepared in it. In drawing 1 , injection of an ink droplet is performed downward.

[0010] The ink tank 2 consists of 1st \*\* 3 which stores ink 12, and 2nd \*\* 8 which has the 2nd porosity member 9. The ink tank 2 can be formed by PET (polyethylene terephthalate). The atmospheric-air free passage hole 4 which keeps the pressure of the 1st \*\* equal to atmospheric pressure is formed in 1st \*\* 3, and in order to prevent ink flowing into the lower part of the atmospheric-air free passage hole 4 out of an atmospheric-air free passage hole, the mesh member 5 which does not let through and ink pass is arranged only in air. The ingredient which performed fluororesin coating for example, in the SUS mesh filter, and gave water repellence to it, and the thing which waterproofed on the cloth woven precisely can be used for the mesh

member 5.

[0011] 2nd \*\* 8 will be in a sealing condition, if a duct 6 and the passage 11 of the ink to the recording head section 1 are blocked. 2nd \*\* 8 had volume of about 1.5 cc, and the 2nd porosity member 9 occupies abbreviation one half. The volume of this 2nd \*\* 8 is constituted in 3 or less times of the volume of a duct 6. As foam used for the 2nd porosity member 9, there are polyester felt, urethane foam, a plastics sintered compact, etc., for example. Moreover, in order to generate moderate holding pressure, the opening consistency needs to be controlled suitably and average boar size has desirable about 200micro.

[0012] The 1st \*\* 3 and 2nd \*\* 8 are connected by the duct 6. Atmospheric-air release of 1st \*\* 3 is carried out, and 2nd \*\* 8 is sealed. Therefore, the ink which the difference of elevation of the oil level of ink 12 and the edge of a duct 6 and the differential pressure of atmospheric air and 2nd \*\* 8 acted on the edge of the duct 6 by the side of 2nd \*\* 8, and was stored in 1st \*\* 3 of the ink tank 2 is supplied to 2nd \*\* 8 by the duct 6 which connects the 1st \*\* 3 and 2nd \*\* 8. The 1st porosity member 7 is formed in the 1st [ of a duct 6 ] \*\* side. The 1st porosity member 7 has prevented that air mixes in a duct 6, when an ink jet cartridge is made reverse. The felt, a cellulose sponge, urethane foam, etc. can be used as an ingredient.

[0013] A duct 6 can be formed by the case and one, and opening by the side of the 1st \*\* is prepared in the abbreviation pars basilaris ossis occipitalis of an ink tank, touches the 1st porosity member 7, or makes it buried, and is arranged. Moreover, opening by the side of the 2nd \*\* is in a location usually higher than the liquid ink side at the time of use. Moreover, the meandering section which is not illustrated can be prepared in a duct 6, and the complete product of a duct can be set to about 0.5 cc.

[0014] The tip of a duct 6 is projected to the 2nd indoor space. A lobe can be made into the tip outer diameter of 400 micrometers, and the bore of 200 micrometers. The coat of the duct 6 is carried out by the fluorine system coating agent with the interior and exterior, and it is constituted so that ink may have the contact angle of about 60 degrees. As a coating ingredient of \*\* ink nature, silicone resin:SR2410 (Dow Corning, Inc., Toray Industries), fluorine-containing silicon KP-801 (Shin-etsu chemistry incorporated company), etc. can be used, for example.

[0015] The 2nd porosity member 9 has the crevice of the configuration near the spherical surface which set the tip of this duct 6 as the abbreviation core. When using this ink jet cartridge, in case an ink droplet trickles into the 2nd porosity member 9 from the tip of a duct 6, even if the dropping direction shifts by vibration etc., it is arranged so that it can absorb to foam certainly. Moreover, by setting up so that the ink side included in the 2nd porosity member 9 may come above near the pars basilaris ossis occipitalis of a crevice, the dropped ink is held in the ink in the 2nd porosity member 9, and winning of air can be reduced. For example, as shown in drawing 2, a crevice can be prepared near the center section which ink trickles, and it can constitute from this part so that an ink side may be exposed. Of course, it is also possible to form combining the crevice a spherical-surface configuration and near a center section. The filter 10 which carries out the trap of the dust is formed in the 2nd \*\* bottom, and passage 11 connects with the recording head section 1.

[0016] The ink supply pressure of the recording head section 1 becomes settled in the sum of the difference of elevation of the pressure of 2nd \*\* 8, i.e., differential pressure with atmospheric air, the holding pressure of the 2nd porosity member 9 of 2nd \*\* 8, and a 2nd \*\* 8 and the nozzle side of the recording head section 1. The 2nd porosity member 9 is selected so that this value may turn into a value suitable for printing. As an ink supply pressure, it can be referred to as -30 - -150mmH<sub>2</sub>O, for example.

[0017] The example of the ink supply actuation in one example of the ink jet cartridge of this

invention is explained. In the normal state, the ink of the edge of a duct 6 is held at the edge of a duct 6 with own surface tension of ink. Printing consumption of ink sends the ink filled up with the 2nd porosity member 9 of 2nd \*\* 8 to the recording head section 1. The pressure of 2nd \*\* 8 declines by this. If the negative pressure of 2nd \*\* 8 becomes large and the differential pressure of 1st \*\* 3 and 2nd \*\* 8 exceeds the surface tension of the ink at the tip of a duct 6, and the force by the difference of elevation, keeping by the surface tension of the ink in the edge of a duct 6 will collapse, ink will flow out of the edge of a duct 6, a drop will be formed, and, finally it will be dropped at the 2nd porosity member 9. The pressure of 2nd \*\* 8 is eased by dropping of ink. Thereby, the balance with the surface tension of the ink in the tip of a duct and the sum of the difference of elevation of 2nd \*\* 8 and the nozzle side of the recording head section 1 is recovered, and the differential pressure of 1st \*\* 3 and 2nd \*\* 8 stops dropping of ink. Thus, the ink of the almost same amount as having consumed by printing is supplied to 2nd \*\* 8 from 1st \*\* 3.

[0018] Thus, although the oil level of ink 12 is in a location higher than the nozzle of the recording head section 1, proper negative pressure can be made to act on a nozzle in the ink jet cartridge of this invention. Therefore, in the edge by the side of 2nd \*\* 8 of a duct 6, it is necessary to once intercept the ink passage which results in the recording head section 1 from 1st \*\* 3 with the surface tension of ink in this invention. The maintenance condition of the ink by the capillary tube force of the duct 6 at this time becomes important. Drawing 3 thru/or drawing 6 are the explanatory views of the maintenance condition of the ink near the point of a duct 6. As shown in drawing 3, when setting [ a contact angle ] the radius of gamma and a duct 6 to r for the surface tension of theta and ink, differential pressure P is called for by  $P=2 \times \gamma \sin \theta / r$ . The holding pressure force P is 52mmH(s)2 O at the time of the radius of  $r=100$  micrometers of theta= 60 degrees of contact angles from this relation, surface tension  $\gamma=30$  dyn/cm of ink, and a duct 6. As shown in drawing 4, when the front face of ink has spread even in the outer diameter of a duct 6, two are set to  $1/r$  of the outer diameter of a duct 6, for example,  $r=200$  micrometers, then the holding pressure force P are set to one half of 26mmH(s)2 O. Thus, the holding pressure force will change with the adhesion conditions of the ink in the tip of a duct 6.

[0019] Therefore, in order to maintain the maintenance condition of ink at stability, it is effective to perform surface treatment near the tip of a duct 6. If coating 13 etc. performs surface treatment of \*\* ink nature outside as shown in drawing 5, maintenance of ink is performed by being stabilized with the wall of a duct 6, and can be performed by stabilizing supply of the ink to the recording head section 1 as a result.

[0020] Moreover, if a taper is attached at the tip of a capillary tube and the outer diameter at the tip of a capillary tube is made thin as shown in drawing 6, change of the path of an effectual duct becomes small and can make fluctuation of ink holding pressure small. Also in this case, the ink stabilized further can be supplied to near a tip and the external surface of a duct by performing coating of \*\* ink nature.

[0021] The case where environmental conditions, such as temperature and an atmospheric pressure, are changed while in use is explained. Keeping is maintained without the atmospheric pressure in 2nd \*\* 8 becoming high superfluously by returning the ink in a duct 6 to 1st \*\* 3 by the rise of temperature, or reduction of atmospheric pressure, if the atmospheric pressure of the 2nd \*\* increases relatively. The allobar by the allobar and temperature change which may generally happen is about 30% at the maximum. By this change, the ink outflow from a nozzle is prevented by returning 30% of ink of the air volume of 2nd \*\* 8 to 1st \*\* 3. Since the capillary tube force by the duct 6 stops acting suitably when a duct 6 replaces with air completely at this

time, it is not desirable. Moreover, if air flows into 1st \*\* 3, it will become impossible to be equal to fluctuation of a repeat, and actuation will be spoiled. Therefore, as for the capacity of a duct 6, it is desirable to have 30% or more of the air volume of 2nd \*\* 8, and 1/3 or more [ of the volume of 2nd \*\* 8 ] is desirable in it being stabilized and operating.

[0022] The recording head section 1 and the ink tank 2 as shown in drawing 1 do not restrict the ink jet cartridge of this invention to the configuration of one. For example, the recording head section 1 and the ink tank 2 can be constituted from another object, and the ink tank 2 can be constituted removable as indicated by above-mentioned Japanese Patent Application No. No. 285745 [ three to ]. In this case, in the condition that the ink tank 2 has separated from the recording head section 1, it is necessary to take into consideration the sealing nature of 2nd \*\* 8. Therefore, in case the passage 11 of ink prepares the packing member by the seal member, rubber, etc. in the part separated on the way as the joint section and equips it with the ink tank 2 at the recording head section 1, it can constitute so that the ink passage from the recording head section 1 may penetrate the joint section. Moreover, a valve can be prepared in the joint section and the configuration which a valve opens at the time of wearing of the ink tank 2 can also be used.

[0023] Moreover, it is also possible to constitute 1st \*\* 3 removable. Drawing 7 is a block diagram at the time of constituting the 1st \*\* removable. 14 are the connection section among drawing. In this case, it leaves the 1st porosity member 7, and 1st \*\* 3 is detached and attached. Also where 1st \*\* 3 is removed, unless ink sinks into the 1st porosity member 7 and it is left over a long period of time, air does not enter in a duct 6. Moreover, even when equipment is leaned in this condition, ink is not spilt out to other parts according to the capillary tube force of the 1st porosity member 7. Also in such a configuration, it is necessary to constitute 1st \*\* 3 so that ink may not leak in the condition of having been removed. For example, a seal member, a valve, etc. are prepared in the connection section 14 connected with the 1st porosity member 7, at the time of wearing, opening can be carried out to a seal member, or the configuration which opens a valve can be used. Or it can also consider as the configuration which opens and closes the atmospheric-air free passage hole 4 according to attachment and detachment of 1st \*\* 3. Thus, by constituting 1st \*\* 3 removable, the configuration of an exchange part can be simplified, and the amount of ink which miniaturizes or holds a component part can be made to increase, and a running cost can be reduced. Of course, 1st \*\* 3 can be constituted removable and can be constituted for 2nd \*\* 8 to the recording head section 1, enabling still freer attachment and detachment. In this case, the part of 2nd \*\* 8 without the need for exchange can be fixed, and the recording head section 1 and 1st \*\* 3 with the need for exchange can be made exchangeable.

[0024]

[Effect of the Invention] Even if it is the case where it equips after easing the conditions about the handling of a cartridge, for example, making a cartridge into an upside-down according to this invention so that clearly from the above explanation, ink leakage etc. cannot be caused but it can be made to operate normally. Moreover, the effectiveness that a reliable ink jet cartridge can be offered has change of installation conditions, such as an inclination, a temperature, an atmospheric pressure, etc., etc. by easing the environmental condition to be used and making always proper the ink pressure supplied to a recording head.

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## TECHNICAL FIELD

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[Industrial Application] This invention relates to the ink jet cartridge used for an ink jet printer.

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## PRIOR ART

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[Description of the Prior Art] As for a printer, in an ink jet cartridge, the liquid ink side of an ink tank may become higher than a recording head nozzle side constitutionally. In such a case, the water head differential pressure by difference of height joins the nozzle side of a recording head, and ink flows out from a nozzle. In order to prevent this, a means to generate negative pressure is needed in an ink tank.

[0003] Into this ink tank, as a means to generate negative pressure, porous members, such as sponge, are arranged in an ink tank, and the method of using that capillary tube force is common, and is used widely. However, it had the fault of being unable to exhaust the ink with which could not fill up sponge with ink completely and it filled up, and the miniaturization of a cartridge was difficult. Moreover, although the method of preparing a pressure adjustment valve between an ink tank and a recording head was also proposed, while becoming expensive, it was easy to produce failure of a pressure adjustment valve, and was not suitable for actual use.

[0004] Moreover, there is a technique which connects the 1st \*\* which stores ink which is indicated by Japanese Patent Application No. No. 285745 [ three to ], the 2nd sealed \*\*, and the 1st \*\* and 2nd \*\* with a capillary tube. With this technique, ink is supplied to the 2nd \*\* by the differential pressure of the atmospheric pressure concerning the 1st indoor ink, and the 2nd indoor negative pressure by consumption of the ink in a recording head through a capillary tube. At this time, ink \*\* in the 2nd \*\* and recording head is fixed with the surface tension of ink in opening by the side of the 2nd [ of a capillary tube ] \*\*.

[0005] According to this technique, ink can be supplied to a recording head by the proper pressure. However, when a cartridge is held to reverse depending on the processing method of a cartridge, for example, the air of the 1st \*\* may enter into the 2nd \*\* through a capillary tube, the pressure in the 2nd \*\* may rise, and good negative pressure cannot be held to a recording head, but ink may be spilt out from the nozzle of a recording head. Moreover, there was a problem of it becoming impossible for that the air of the 2nd \*\* will enter in a capillary tube by fluctuation of an atmospheric pressure or change of temperature if the volume of the air of the 2nd \*\* changes, the inside of a capillary tube will be filled with air, for example, the 2nd indoor air escapes to the 1st \*\* etc. to maintain the balance of the pressure by the capillary tube force.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Even if it is the case where it equips after easing the conditions about the handling of a cartridge, for example, making a cartridge into an upside-down according to this invention so that clearly from the above explanation, ink leakage etc. cannot be caused but it can be made to operate normally. Moreover, the effectiveness that a reliable ink jet cartridge can be offered has change of installation conditions, such as an inclination, a temperature, an atmospheric pressure, etc., etc. by easing the environmental condition to be used and making always proper the ink pressure supplied to a recording head.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] This invention aims at offering a reliable ink jet cartridge by having been made in view of the situation mentioned above, losing the leakage and \*\*\*\*\* of ink by the handling of a cartridge, change of atmospheric temperature, and change of



the external environment of fluctuation of an atmospheric pressure, and making always proper the ink pressure supplied to a recording head.

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## MEANS

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[Means for Solving the Problem] In the ink jet cartridge which uses this invention for the ink jet recording apparatus which has a recording head and an ink tank said ink tank The 1st \*\* which mainly stores ink and has opening with atmospheric air, and the 2nd sealed \*\* which has a porosity member, As it has the duct which connects said the 1st \*\* and 2nd \*\* and ink trickles from the tip by the side of the 2nd [ of said duct ] \*\*, in invention according to claim 1, it is characterized by having a porosity member in opening by the side of the 1st [ of said duct ] \*\*. Moreover, in invention according to claim 2, it is characterized by the thing of said duct constituted so that the opening tip by the side of the 2nd \*\* may have water repellence at least. Furthermore, in invention according to claim 3, it is characterized by establishing a crevice in the porosity member allotted to said 2nd \*\*. In invention according to claim 4, it is characterized by the volume of said 2nd \*\* being constituted by 3 or less times of the volume of said duct.

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## OPERATION

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[Function] Since ink is held by the porosity member even when a cartridge is made reverse in invention according to claim 1 by preparing a porosity member in opening by the side of the 1st [ of a duct ] \*\* according to this invention, it can prevent air invading in a duct. Moreover, in invention according to claim 2, it can prevent that the front face of an ink droplet becomes large unusually at opening of a duct, and the balance of ink \*\* collapses by [ of a duct ] giving water repellence at the tip of opening by the side of the 2nd \*\* at least. Furthermore, in invention according to claim 3, even when ink trickles aslant from opening of a duct by some inclinations by establishing a crevice in the porosity member allotted to the 2nd \*\*, while being able to make a porosity member absorb ink certainly, the ink absorbed by the porosity member and the dropped ink can be held, without winning air. In invention according to claim 4, when the volume of the 2nd \*\* is constituted by 3 or less times of the volume of a duct, even if the 2nd indoor air expands and it invades in a duct by change of temperature or an atmospheric pressure, the overall length of a duct is not filled by air. By these configurations, change of ink \*\* by change of the environment of change of handling and temperature of a cartridge, or an atmospheric pressure can be suppressed, and always good ink \*\* can be secured.

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## EXAMPLE

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[Example] Drawing 1 is the outline block diagram showing one example of the ink jet cartridge of this invention. the inside of drawing, and 1 -- the recording head section and 2 -- an ink tank and 3 -- the 1st \*\* and 4 -- an atmospheric-air free passage hole and 5 -- a mesh member and 6 -- for the 2nd \*\* and 9, as for a filter and 11, the 2nd porosity member and 10 are [ a duct and 7 / the 1st porosity member and 8 / passage and 12 ] ink. A recording head 1 consists of a heat sink with which the head chip was attached, a printed-circuit board which supplies an electrical signal to a head chip, a manifold which supplies ink to a head chip. It is not illustrating about these configurations. Many nozzles are formed in the head chip by high density. For example, 128 nozzles can be arranged by the consistency of 300spi(s). Each nozzle is made to generate air bubbles by energization, and the heating element for injecting an ink droplet is prepared in it. In

drawing 1 , injection of an ink droplet is performed downward.

[0010] The ink tank 2 consists of 1st \*\* 3 which stores ink 12, and 2nd \*\* 8 which has the 2nd porosity member 9. The ink tank 2 can be formed by PET (polyethylene terephthalate). The atmospheric-air free passage hole 4 which keeps the pressure of the 1st \*\* equal to atmospheric pressure is formed in 1st \*\* 3, and in order to prevent ink flowing into the lower part of the atmospheric-air free passage hole 4 out of an atmospheric-air free passage hole, the mesh member 5 which does not let through and ink pass is arranged only in air. The ingredient which performed fluororesin coating for example, in the SUS mesh filter, and gave water repellence to it, and the thing which waterproofed on the cloth woven precisely can be used for the mesh member 5.

[0011] 2nd \*\* 8 will be in a sealing condition, if a duct 6 and the passage 11 of the ink to the recording head section 1 are blocked. 2nd \*\* 8 had volume of about 1.5 cc, and the 2nd porosity member 9 occupies abbreviation one half. The volume of this 2nd \*\* 8 is constituted in 3 or less times of the volume of a duct 6. As foam used for the 2nd porosity member 9, there are polyester felt, urethane foam, a plastics sintered compact, etc., for example. Moreover, in order to generate moderate holding pressure, the opening consistency needs to be controlled suitably and average boar size has desirable about 200micro.

[0012] The 1st \*\* 3 and 2nd \*\* 8 are connected by the duct 6. Atmospheric-air release of 1st \*\* 3 is carried out, and 2nd \*\* 8 is sealed. Therefore, the ink which the difference of elevation of the oil level of ink 12 and the edge of a duct 6 and the differential pressure of atmospheric air and 2nd \*\* 8 acted on the edge of the duct 6 by the side of 2nd \*\* 8, and was stored in 1st \*\* 3 of the ink tank 2 is supplied to 2nd \*\* 8 by the duct 6 which connects the 1st \*\* 3 and 2nd \*\* 8. The 1st porosity member 7 is formed in the 1st [ of a duct 6 ] \*\* side. The 1st porosity member 7 has prevented that air mixes in a duct 6, when an ink jet cartridge is made reverse. The felt, a cellulose sponge, urethane foam, etc. can be used as an ingredient.

[0013] A duct 6 can be formed by the case and one, and opening by the side of the 1st \*\* is prepared in the abbreviation pars basilaris ossis occipitalis of an ink tank, touches the 1st porosity member 7, or makes it buried, and is arranged. Moreover, opening by the side of the 2nd \*\* is in a location usually higher than the liquid ink side at the time of use. Moreover, the meandering section which is not illustrated can be prepared in a duct 6, and the complete product of a duct can be set to about 0.5 cc.

[0014] The tip of a duct 6 is projected to the 2nd indoor space. A lobe can be made into the tip outer diameter of 400 micrometers, and the bore of 200 micrometers. The coat of the duct 6 is carried out by the fluorine system coating agent with the interior and exterior, and it is constituted so that ink may have the contact angle of about 60 degrees. As a coating ingredient of \*\* ink nature, silicone resin:SR2410 (Dow Corning, Inc., Toray Industries), fluorine-containing silicon KP-801 (Shin-etsu chemistry incorporated company), etc. can be used, for example.

[0015] The 2nd porosity member 9 has the crevice of the configuration near the spherical surface which set the tip of this duct 6 as the abbreviation core. When using this ink jet cartridge, in case an ink droplet trickles into the 2nd porosity member 9 from the tip of a duct 6, even if the dropping direction shifts by vibration etc., it is arranged so that it can absorb to foam certainly. Moreover, by setting up so that the ink side included in the 2nd porosity member 9 may come above near the pars basilaris ossis occipitalis of a crevice, the dropped ink is held in the ink in the 2nd porosity member 9, and winning of air can be reduced. For example, as shown in drawing 2 , a crevice can be prepared near the center section which ink trickles, and it can constitute from this part so that an ink side may be exposed. Of course, it is also possible to form combining the crevice a spherical-surface configuration and near a center section. The filter 10 which carries

out the trap of the dust is formed in the 2nd \*\* 8 bottom, and passage 11 connects with the recording head section 1.

[0016] The ink supply pressure of the recording head section 1 becomes settled in the sum of the difference of elevation of the pressure of 2nd \*\* 8, i.e., differential pressure with atmospheric air, the holding pressure of the 2nd porosity member 9 of 2nd \*\* 8, and a 2nd \*\* 8 and the nozzle side of the recording head section 1. The 2nd porosity member 9 is selected so that this value may turn into a value suitable for printing. As an ink supply pressure, it can be referred to as -30 - -150mmH<sub>2</sub>O, for example.

[0017] The example of the ink supply actuation in one example of the ink jet cartridge of this invention is explained. In the normal state, the ink of the edge of a duct 6 is held at the edge of a duct 6 with own surface tension of ink. Printing consumption of ink sends the ink filled up with the 2nd porosity member 9 of 2nd \*\* 8 to the recording head section 1. The pressure of 2nd \*\* 8 declines by this. If the negative pressure of 2nd \*\* 8 becomes large and the differential pressure of 1st \*\* 3 and 2nd \*\* 8 exceeds the surface tension of the ink at the tip of a duct 6, and the force by the difference of elevation, keeping by the surface tension of the ink in the edge of a duct 6 will collapse, ink will flow out of the edge of a duct 6, a drop will be formed, and, finally it will be dropped at the 2nd porosity member 9. The pressure of 2nd \*\* 8 is eased by dropping of ink. Thereby, the balance with the surface tension of the ink in the tip of a duct and the sum of the difference of elevation of 2nd \*\* 8 and the nozzle side of the recording head section 1 is recovered, and the differential pressure of 1st \*\* 3 and 2nd \*\* 8 stops dropping of ink. Thus, the ink of the almost same amount as having consumed by printing is supplied to 2nd \*\* 8 from 1st \*\* 3.

[0018] Thus, although the oil level of ink 12 is in a location higher than the nozzle of the recording head section 1, proper negative pressure can be made to act on a nozzle in the ink jet cartridge of this invention. Therefore, in the edge by the side of 2nd \*\* 8 of a duct 6, it is necessary to once intercept the ink passage which results in the recording head section 1 from 1st \*\* 3 with the surface tension of ink in this invention. The maintenance condition of the ink by the capillary tube force of the duct 6 at this time becomes important. Drawing 3 thru/or drawing 6 are the explanatory views of the maintenance condition of the ink near the point of a duct 6. As shown in drawing 3, when setting [ a contact angle ] the radius of gamma and a duct 6 to r for the surface tension of theta and ink, differential pressure P is called for by  $P=2\gamma \sin \theta / r$ . The holding pressure force P is 52mmH<sub>2</sub>O at the time of the radius of  $r=100$  micrometers of  $\theta=60$  degrees of contact angles from this relation, surface tension  $\gamma=30$  dyn/cm of ink, and a duct 6. As shown in drawing 4, when the front face of ink has spread even in the outer diameter of a duct 6, two are set to  $1/r$  of the outer diameter of a duct 6, for example,  $r=200$  micrometers, then the holding pressure force P are set to one half of 26mmH<sub>2</sub>O. Thus, the holding pressure force will change with the adhesion conditions of the ink in the tip of a duct 6.

[0019] Therefore, in order to maintain the maintenance condition of ink at stability, it is effective to perform surface treatment near the tip of a duct 6. If coating 13 etc. performs surface treatment of \*\* ink nature outside as shown in drawing 5, maintenance of ink is performed by being stabilized with the wall of a duct 6, and can be performed by stabilizing supply of the ink to the recording head section 1 as a result.

[0020] Moreover, if a taper is attached at the tip of a capillary tube and the outer diameter at the tip of a capillary tube is made thin as shown in drawing 6, change of the path of an effectual duct becomes small and can make fluctuation of ink holding pressure small. Also in this case, the ink stabilized further can be supplied to near a tip and the external surface of a duct by

performing coating of \*\* ink nature.

[0021] The case where environmental conditions, such as temperature and an atmospheric pressure, are changed while in use is explained. Keeping is maintained without the atmospheric pressure in 2nd \*\* 8 becoming high superfluously by returning the ink in a duct 6 to 1st \*\* 3 by the rise of temperature, or reduction of atmospheric pressure, if the atmospheric pressure of the 2nd \*\* increases relatively. The allobar by the allobar and temperature change which may generally happen is about 30% at the maximum. By this change, the ink outflow from a nozzle is prevented by returning 30% of ink of the air volume of 2nd \*\* 8 to 1st \*\* 3. Since the capillary tube force by the duct 6 stops acting suitably when a duct 6 replaces with air completely at this time, it is not desirable. Moreover, if air flows into 1st \*\* 3, it will become impossible to be equal to fluctuation of a repeat, and actuation will be spoiled. Therefore, as for the capacity of a duct 6, it is desirable to have 30% or more of the air volume of 2nd \*\* 8, and 1/3 or more [ of the volume of 2nd \*\* 8 ] is desirable in it being stabilized and operating.

[0022] The recording head section 1 and the ink tank 2 as shown in drawing 1 do not restrict the ink jet cartridge of this invention to the configuration of one. For example, the recording head section 1 and the ink tank 2 can be constituted from an another object, and the ink tank 2 can be constituted removable as indicated by above-mentioned Japanese Patent Application No. No. 285745 [ three to ]. In this case, in the condition that the ink tank 2 has separated from the recording head section 1, it is necessary to take into consideration the sealing nature of 2nd \*\* 8. Therefore, in case the passage 11 of ink prepares the packing member by the seal member, rubber, etc. in the part separated on the way as the joint section and equips it with the ink tank 2 at the recording head section 1, it can constitute so that the ink passage from the recording head section 1 may penetrate the joint section. Moreover, a valve can be prepared in the joint section and the configuration which a valve opens at the time of wearing of the ink tank 2 can also be used.

[0023] Moreover, it is also possible to constitute 1st \*\* 3 removable. Drawing 7 is a block diagram at the time of constituting the 1st \*\* removable. 14 are the connection section among drawing. In this case, it leaves the 1st porosity member 7, and 1st \*\* 3 is detached and attached. Also where 1st \*\* 3 is removed, unless ink sinks into the 1st porosity member 7 and it is left over a long period of time, air does not enter in a duct 6. Moreover, even when equipment is leaned in this condition, ink is not spilt out to other parts according to the capillary tube force of the 1st porosity member 7. Also in such a configuration, it is necessary to constitute 1st \*\* 3 so that ink may not leak in the condition of having been removed. For example, a seal member, a valve, etc. are prepared in the connection section 14 connected with the 1st porosity member 7, at the time of wearing, opening can be carried out to a seal member, or the configuration which opens a valve can be used. Or it can also consider as the configuration which opens and closes the atmospheric-air free passage hole 4 according to attachment and detachment of 1st \*\* 3. Thus, by constituting 1st \*\* 3 removable, the configuration of an exchange part can be simplified, and the amount of ink which miniaturizes or holds a component part can be made to increase, and a running cost can be reduced. Of course, 1st \*\* 3 can be constituted removable and can be constituted for 2nd \*\* 8 to the recording head section 1, enabling still freer attachment and detachment. In this case, the part of 2nd \*\* 8 without the need for exchange can be fixed, and the recording head section 1 and 1st \*\* 3 with the need for exchange can be made exchangeable.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram showing one example of the ink jet cartridge of this invention.

[Drawing 2] It is the explanatory view of another configuration of the 2nd porosity member in one example of the ink jet cartridge of this invention.

[Drawing 3] It is the explanatory view of the maintenance condition of the ink near the point of a duct.

[Drawing 4] It is the explanatory view of the maintenance condition of the ink near the point of a duct.

[Drawing 5] It is the explanatory view of the maintenance condition of the ink near the point of a duct.

[Drawing 6] It is the explanatory view of the maintenance condition of the ink near the point of a duct.

[Drawing 7] It is a block diagram at the time of constituting the 1st \*\* removable in the ink jet cartridge of this invention.

[Description of Notations]

1 The recording head section, 2 An ink tank, 3 The 1st \*\*, 4 An atmospheric-air free passage hole, a five-mesh member, 6 A duct, 7 The 1st porosity member, 8 The 2nd \*\*, 9 The 2nd porosity member, 10 A filter, 11 Passage, 12 Ink, 13 Coating, 14 Connection section.

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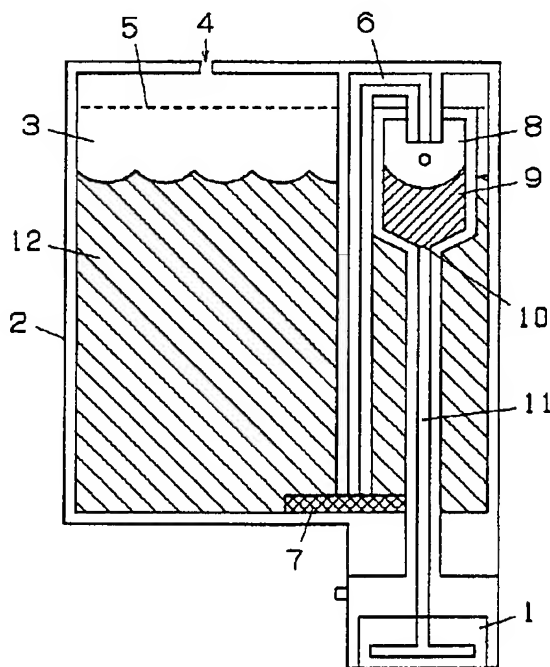
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(54)【発明の名称】 インクジェットカートリッジ

(57)【要約】

【目的】 カートリッジの取り扱いや、気温、気圧の変動等の外部環境が変化しても、記録ヘッドに供給するインク圧力を常に適正に保持し、信頼性の高いインクジェットカートリッジを提供する。

【構成】 第1の室3と第2の室8は、管路6により接続されている。管路6の第2の室8側の端部は、撥インク性を有しており、適正なインクの表面張力により、第2の室8の圧力が調整される。管路6の第1の室3側の端部には、第1の多孔質部材が配されており、カートリッジが逆さにされても第1の室3内の空気が管路6に入り込まない。第2の室8の空気の容積は、管路6の容積の3倍以内に構成されており、気温や気圧の変化により第2の室8内の圧力変化を、管路6により吸収し、記録ヘッド1に対するインク圧は一定に保持される。



【特許請求の範囲】

【請求項1】 記録ヘッドとインクタンクを有するインクジェット記録装置に用いるインクジェットカートリッジにおいて、前記インクタンクは主にインクを貯留し大気との開口を有する第1の室と、多孔質部材を有する密閉された第2の室と、前記第1の室と前記第2の室とを接続する管路と、該管路の第1の室側の開口部に多孔質部材を有し、前記管路の第2の室側の先端よりインクが滴下するようにしたを特徴とするインクジェットカートリッジ。

【請求項2】 記録ヘッドとインクタンクを有するインクジェット記録装置に用いるインクジェットカートリッジにおいて、前記インクタンクは主にインクを貯留し大気との開口を有する第1の室と、多孔質部材を有する密閉された第2の室と、前記第1の室と前記第2の室とを接続し少なくとも第2の室側の開口部先端が撥水性を有するように構成した管路を有し、前記管路の第2の室側の先端よりインクが滴下するようにしたを特徴とするインクジェットカートリッジ。

【請求項3】 記録ヘッドとインクタンクを有するインクジェット記録装置に用いるインクジェットカートリッジにおいて、前記インクタンクは主にインクを貯留し大気との開口を有する第1の室と、凹部を有する多孔質部材が配され密閉された第2の室と、前記第1の室と前記第2の室とを接続する管路を有し、該管路の第2の室側の先端よりインクが滴下するようにしたを特徴とするインクジェットカートリッジ。

【請求項4】 記録ヘッドとインクタンクを有するインクジェット記録装置に用いるインクジェットカートリッジにおいて、前記インクタンクは主にインクを貯留し大気との開口を有する第1の室と、多孔質部材を有する密閉された第2の室と、前記第1の室と前記第2の室とを接続する管路を有し、前記第2の室の容積が前記管路の容積の3倍以下に構成されていることを特徴とするインクジェットカートリッジ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、インクジェットプリンタに用いるインクジェットカートリッジに関するものである。

【0002】

【従来の技術】 インクジェットカートリッジにおいては、プリンタの構成上、インクタンクのインク液面が記録ヘッドノズル面より高くなることがある。このような場合、記録ヘッドのノズル面には高さの相違による水頭差圧が加わり、ノズルよりインクが流出する。これを防止するため、インクタンク内に負圧を発生する手段を必要とする。

【0003】 このインクタンク内に負圧を発生する手段としては、インクタンク内にスポンジなどの多孔性部材

を配置し、その毛細管力を利用する方法が一般的であり、広く用いられている。しかし、スポンジにインクを完全に充填することができず、また、充填されたインクを使い切ることができない等の欠点を有しており、カートリッジの小型化が困難であった。また、インクタンクと記録ヘッド間に圧調整弁を設ける方法も提案されているが、高価となるとともに、圧調整弁の故障が生じやすく、実際の使用には適さなかった。

【0004】 また、特願平3-285745号に記載されているような、インクを貯留する第1の室と、密閉された第2の室と、第1の室と第2の室とを毛細管で接続する技術がある。この技術では、第1の室内のインクにかかる大気圧と、記録ヘッドにおけるインクの消費による第2の室内の負圧との圧力差により、インクが毛細管を介して第2の室に供給される。このとき、毛細管の第2の室側の開口部において、インクの表面張力により、第2の室および記録ヘッドにおけるインク圧を一定にしている。

【0005】 この技術によれば、記録ヘッドに適正な圧力でインクを供給することができる。しかし、カートリッジの取り扱い方によっては、例えばカートリッジを逆さに保持した場合などは、第1の室の空気が毛細管を介して第2の室に入り込み、第2の室における圧力が上昇し、記録ヘッドに対して良好な負圧を保持できず、記録ヘッドのノズルよりインクが流失してしまう場合がある。また、気圧の変動や温度の変化により、第2の室の空気の体積が変化すると、第2の室の空気が毛細管内に入り込み、毛細管内が空気で満たされた状態になり、例えば、第2の室内の空気が第1の室に逃げるなど、毛細管力による圧力のバランスを保てなくなってしまうという問題があった。

【0006】

【発明が解決しようとする課題】 本発明は、上述した事情に鑑みてなされたもので、カートリッジの取り扱いや、気温の変化や、気圧の変動といった外部環境の変化によるインクの漏れやこぼれをなくし、記録ヘッドに供給するインク圧力を常に適正なものとするにより、信頼性の高いインクジェットカートリッジを提供することを目的とするものである。

【0007】

【課題を解決するための手段】 本発明は、記録ヘッドとインクタンクを有するインクジェット記録装置に用いるインクジェットカートリッジにおいて、前記インクタンクは、主にインクを貯留し大気との開口を有する第1の室と、多孔質部材を有する密閉された第2の室と、前記第1の室と第2の室とを接続する管路を有し、前記管路の第2の室側の先端よりインクが滴下するようにしたものであって、請求項1に記載の発明では、前記管路の第1の室側の開口部に多孔質部材を有することを特徴とするものである。また、請求項2に記載の発明では、前記

管路の少なくとも第2の室側の開口部先端が撥水性を有するように構成されていることを特徴とするものである。さらに、請求項3に記載の発明では、前記第2の室に配された多孔質部材に凹部を設けたことを特徴とするものである。請求項4に記載の発明では、前記第2の室の容積が前記管路の容積の3倍以下に構成されていることを特徴とするものである。

#### 【0008】

【作用】本発明によれば、請求項1に記載の発明において、管路の第1の室側の開口部に多孔質部材を設けることにより、例えば、カートリッジを逆さにされた場合でも、多孔質部材によりインクが保持されるので、管路内に空気の侵入するのを防ぐことができる。また、請求項2に記載の発明において、管路の少なくとも第2の室側の開口部先端に撥水性を持たせることにより、管路の開口部にインク滴の表面が異常に大きくなって、インク圧のバランスが崩れるのを防止することができる。さらに、請求項3に記載の発明において、第2の室に配された多孔質部材に凹部を設けることにより、多少の傾斜により管路の開口部から斜めにインクが滴下する場合でも、インクを確実に多孔質部材に吸収させることができるとともに、多孔質部材に吸収されているインクと滴下するインクを、空気を抱き込むことなく収容することができる。請求項4に記載の発明において、第2の室の容積が管路の容積の3倍以下に構成されることにより、温度や気圧の変化により、第2の室内の空気が膨張して管路内に侵入しても、管路の全長が空気により満たされることはない。これらの構成により、カートリッジの取り扱いや、温度や気圧の変化といった環境の変化によるインク圧の変化を抑え、常に良好なインク圧を確保することができる。

#### 【0009】

【実施例】図1は、本発明のインクジェットカートリッジの一実施例を示す概略構成図である。図中、1は記録ヘッド部、2はインクタンク、3は第1の室、4は大気連通孔、5はメッシュ部材、6は管路、7は第1の多孔質部材、8は第2の室、9は第2の多孔質部材、10はフィルタ、11は流路、12はインクである。記録ヘッド1は、ヘッドチップが取り付けられたヒートシンクと、ヘッドチップに電気信号を供給するプリント配線基板、ヘッドチップにインクを供給するマニホールドなどから構成される。これらの構成については、図示していない。ヘッドチップには、多数のノズルが高密度で形成されている。例えば、128本のノズルを300spiの密度で配置することができる。各ノズルには、通電によって気泡を発生させ、インク滴を噴射するための発熱体が設けられている。図1において、インク滴の噴射は下向きに行なわれる。

【0010】インクタンク2は、インク12を貯蔵する第1の室3と、第2の多孔質部材9を有する第2の室8

とからなる。インクタンク2は、例えば、PET（ポリエチレンテレフタレート）で形成することができる。第1の室3には第1の室の圧力を大気圧に等しく保つ大気連通孔4が設けられており、大気連通孔4の下部にはインクが大気連通孔から流出するのを防ぐため、空気のみを通し、インクを通さないメッシュ部材5が配置されている。メッシュ部材5は、例えば、SUSメッシュフィルタにフッ素樹脂コーティングを行なって撥水性を付与した材料や、緻密に織られた布に防水加工を行なったものを用いることができる。

【0011】第2の室8は、管路6および記録ヘッド部1へのインクの流路11を封鎖すると、密閉状態となる。第2の室8は、約1.5ccの容積を持ち、略半分を第2の多孔質部材9が占めている。この第2の室8の容積は、管路6の容積の3倍以下に構成する。第2の多孔質部材9に用いられる多孔性材料としては、例えば、ポリエステルフェルト、ウレタンフォーム、プラスチック焼結体などがある。また、適度な保持圧を発生させるため、その空隙密度が適宜制御されている必要があり、平均ポアサイズは200μm程度が望ましい。

【0012】第1の室3と第2の室8は、管路6によって連結されている。第1の室3は大気解放されており、第2の室8は密閉されている。従って、第2の室8側の管路6の端部には、インク12の液面と管路6の端部の高低差、および、大気と第2の室8の差圧が作用し、インクタンク2の第1の室3に蓄えられたインクは、第1の室3と第2の室8とを接続する管路6によって、第2の室8に供給される。管路6の第1の室側には、第1の多孔質部材7が設けられている。第1の多孔質部材7は、インクジェットカートリッジを例えば逆さにした場合に、管路6に空気が混入するのを防止している。材料としては、フェルト、セルローススポンジ、ウレタンフォームなどを用いることができる。

【0013】管路6は、ケースと一体で形成することができ、第1の室側の開口はインクタンクの略底部に設けられ、第1の多孔質部材7に接して、または、埋没させて配置されている。また、第2の室側の開口は、通常使用時のインク液面より高い位置にある。また、管路6には、図示しない蛇行部を設けることができ、管路の全容積を約0.5ccとすることができる。

【0014】管路6の先端は、第2の室内の空間に突出している。突出部は、例えば先端外径400μm、内径200μmとすることができる。管路6は、その内部および外部とともにフッ素系コーティング剤でコートされており、インクが約60度の接触角を有するように構成されている。撥インク性のコーティング材料としては、例えば、シリコーン樹脂：SR2410（東レ・ダウコーニング株式会社）や、含フッ素シリコンKP-801（信越化学株式会社）等を用いることができる。

【0015】第2の多孔質部材9は、この管路6の先端



を略中心とした球面に近い形状の凹部を有している。このインクジェットカートリッジを使用する時に、管路6の先端からインク滴が第2の多孔質部材9へ滴下する際に、振動等により滴下方向がずれても確実に多孔性材料に吸収することができるように配置されている。また、第2の多孔質部材9に含まれているインク面が凹部の底部付近より上になるように設定することにより、滴下したインクが第2の多孔質部材9内のインクに収容され、空気の抱き込みを低減することができる。例えば、図2に示したように、インクの滴下する中央部付近に凹部を設けて、この部分ではインク面が露出するように構成することができる。もちろん、球面形状と中央部付近の凹部を組み合わせ形成することも可能である。第2の室の下側には、ゴミをトラップするフィルタ10が設けられており、流路11により記録ヘッド部1と接続されている。

【0016】記録ヘッド部1のインク供給圧は、第2の室8の圧力、すなわち、大気との差圧と、第2の室8の第2の多孔質部材9の保持圧と、第2の室8と記録ヘッド部1のノズル面との高低差の和で定まる。この値が印字に適した値になるように、第2の多孔質部材9が選定される。インク供給圧としては、例えば、 $-30 \sim -150 \text{ mmHg}$  Oとすることができる。

【0017】本発明のインクジェットカートリッジの一実施例におけるインク供給動作の例について説明する。通常状態では、管路6の端部のインクは、インク自身の表面張力によって、管路6の端部に保持されている。印字によってインクが消費されると、第2の室8の第2の多孔質部材9を充填しているインクが記録ヘッド部1に送られる。これによって第2の室8の圧力が低下する。第2の室8の負圧が大きくなり、第1の室3と第2の室8の圧力差が管路6の先端のインクの表面張力と高低差による力を上回ると、管路6の端部におけるインクの表面張力による釣合が崩れ、管路6の端部からインクが流出し、液滴を形成し、最終的に第2の多孔質部材9に滴下する。第2の室8の圧力は、インクの滴下によって緩和される。これにより、第1の室3と第2の室8の圧力差が、管路先端でのインクの表面張力と、第2の室8と記録ヘッド部1のノズル面との高低差の和との釣り合いが回復し、インクの滴下は停止する。このようにして、印字によって消費したのとはほぼ同じ量のインクが、第1の室3から第2の室8へ供給される。

【0018】このように、本発明のインクジェットカートリッジでは、インク12の液面が記録ヘッド部1のノズルより高い位置にあるにもかかわらず、ノズルに適正な負圧を作用させることができる。そのために、本発明においては、第1の室3から記録ヘッド部1にいたるインク流路を、管路6の第2の室8側の端部において、一旦インクの表面張力で遮断する必要がある。このときの管路6の毛細管力によるインクの保持状態が重要とな

る。図3乃至図6は、管路6の先端部付近のインクの保持状態の説明図である。図3に示すように、接触角を $\theta$ 、インクの表面張力を $\gamma$ 、管路6の半径を $r$ とすると、圧力差 $P$ は、

$$P = 2 \times \gamma \times \sin \theta / r$$

で求められる。この関係から、接触角 $\theta = 60^\circ$ 、インクの表面張力 $\gamma = 30 \text{ dyne/cm}$ 、管路6の半径 $r = 100 \mu\text{m}$ のとき、保持圧 $P$ は $52 \text{ mmHg}$  Oである。図4に示すように、インクの表面が、管路6の外径にまで広がってしまった場合には、管路6の外径の $1/2$ が $r$ となり、例えば $r = 200 \mu\text{m}$ とすれば、保持圧 $P$ は $1/2$ の $26 \text{ mmHg}$  Oとなる。このように、管路6の先端におけるインクの付着状態によって、保持圧力が変化してしまう。

【0019】そのため、インクの保持状態を安定に保つには、管路6の先端付近の表面処理を施すことが効果的である。図5に示すように、コーティング13などによって外面に撥インク性の表面処理を行なっておくと、インクの保持は管路6の内壁で安定して行なわれ、結果として記録ヘッド部1へのインクの供給も安定して行なうことができる。

【0020】また、図6に示すように、毛細管先端にテーパーをつけ、毛細管先端の外径を細くすると、実効的な管路の径の変化が小さくなり、インク保持圧の変動を小さくすることができる。この場合も、管路の先端付近や外面に、撥インク性のコーティングを施すことにより、さらに安定したインクの供給を行なうことができる。

【0021】使用中に温度や気圧等の環境条件が変動する場合について説明する。温度の上昇、あるいは大気圧の減少によって、第2の室の気圧が相対的に増加すると、管路6内のインクが第1の室3へ戻されることによって、第2の室8内の気圧が過剰に高くなることなく、釣合が保たれる。一般に起こり得る気圧変化や温度変化による気圧変化は、最大で30%程度である。この変化によって、第2の室8の空気容積の30%のインクが第1の室3へ戻されることによって、ノズルからのインク流出が防止される。このとき、管路6が完全に空気で置き換わると、管路6による毛細管力が好適に作用しなくなるので好ましくない。また、空気が第1の室3へ流入してしまうと、繰り返しの変動に耐えられなくなり、動作が損なわれる。従って、管路6の容量は、第2の室8の空気容積の30%以上を有することが望ましく、安定して動作するには第2の室8の容積の $1/3$ 以上が望ましい。

【0022】本発明のインクジェットカートリッジは、図1に示されているような、記録ヘッド部1とインクタンク2が一体の構成に限らない。例えば、前出の特願平3-285745号に記載されているように、記録ヘッド部1とインクタンク2を別体で構成し、インクタンク

2を着脱可能に構成することができる。この場合には、インクタンク2が記録ヘッド部1から外れている状態において、第2の室8の密閉性を考慮する必要がある。そのために、インクの流路11が途中で分離される部分に、ジョイント部として、シール部材やゴム等によるパッキング部材を設けて、インクタンク2を記録ヘッド部1に装着する際に、記録ヘッド部1からのインク流路がジョイント部を貫通するように構成することができる。また、ジョイント部に弁を設け、インクタンク2の装着時に弁が開く構成を用いることもできる。

【0023】また、第1の室3を着脱可能に構成することも可能である。図7は、第1の室を着脱可能に構成した場合の構成図である。図中、14は連結部である。この場合には、第1の多孔質部材7を残して第1の室3が着脱される。第1の室3が外された状態でも、第1の多孔質部材7にインクが含浸されており、長期にわたり放置されない限り、管路6内に空気が入り込むことはない。また、この状態で装置を傾けた場合でも、第1の多孔質部材7の毛細管力により、インクが他の部分へ流失することもない。このような構成の場合にも、第1の室3は、取り外された状態でインクが漏れないように構成する必要がある。例えば、第1の多孔質部材7に連結される連結部14に、シール部材や弁等を設け、装着時にシール部材に開口したり、弁を開ける構成を用いることができる。または、大気連通孔4を第1の室3の着脱に応じて開閉する構成とすることもできる。このように、第1の室3を着脱可能に構成することにより、交換部分の構成を簡素化し、また、構成部品を小型化し、または収容するインク量を増加させることができ、ランニングコストを低減することができる。もちろん、第1の室3を着脱可能に構成し、さらに、第2の室8から記録ヘッド部1を着脱自在に構成することができる。この場合には、交換の必要のない第2の室8の部分を固定し、交換の必要のある記録ヘッド部1と第1の室3を交換可能と

することができる。

#### 【0024】

【発明の効果】以上の説明から明らかなように、本発明によれば、カートリッジの取り扱いに関する条件を緩和し、例えば、カートリッジを逆さまにした後に装着した場合であっても、インク漏れなどを起こさず、正常に動作させることができる。また、傾斜などの設置状態や温度、気圧などの変化など、使用する環境条件を緩和し、記録ヘッドに供給するインク圧力を常に適正なものとするることにより、信頼性の高いインクジェットカートリッジを提供することができるという効果がある。

#### 【図面の簡単な説明】

【図1】 本発明のインクジェットカートリッジの一実施例を示す概略構成図である。

【図2】 本発明のインクジェットカートリッジの一実施例における第2の多孔質部材の別の形状の説明図である。

【図3】 管路の先端部付近のインクの保持状態の説明図である。

【図4】 管路の先端部付近のインクの保持状態の説明図である。

【図5】 管路の先端部付近のインクの保持状態の説明図である。

【図6】 管路の先端部付近のインクの保持状態の説明図である。

【図7】 本発明のインクジェットカートリッジにおいて第1の室を着脱可能に構成した場合の構成図である。

#### 【符号の説明】

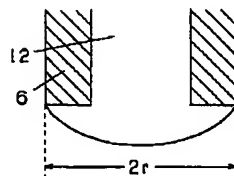
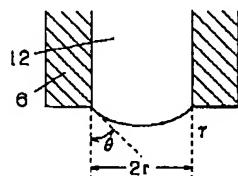
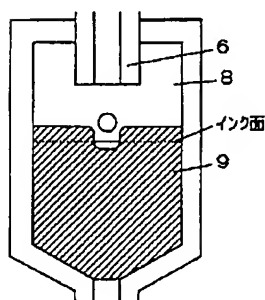
1 記録ヘッド部、2 インクタンク、3 第1の室、4 大気連通孔、5 メッシュ部材、6 管路、7 第1の多孔質部材、8 第2の室、9 第2の多孔質部材、10 フィルタ、11 流路、12 インク、13 コーティング、14 連結部。

【図2】

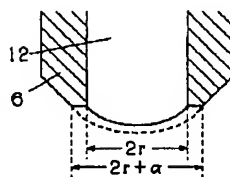
【図3】

【図4】

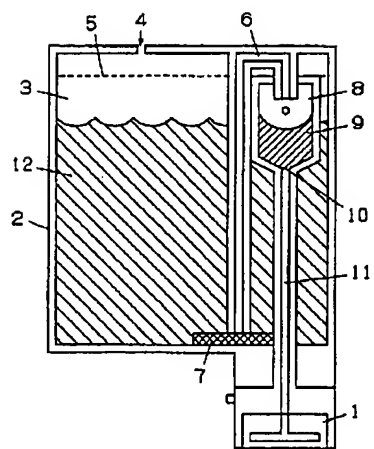
【図5】



【図6】



【図1】



【図7】

